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AEC ATOMIC WEAPON DATA

SC-M-67-726

[illegible]

HISTORY OF THE MK 6 BOMB (U)

(Including the TX/XW-13, Mk 18 and TX-20)

SC-M-67-726

Redacted Version

SC-M-670726
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Weapon Systems

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Sandia Systematic Declassification Review
RETAIN CLASSIFICATION
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Classified By: Richard B. Craner
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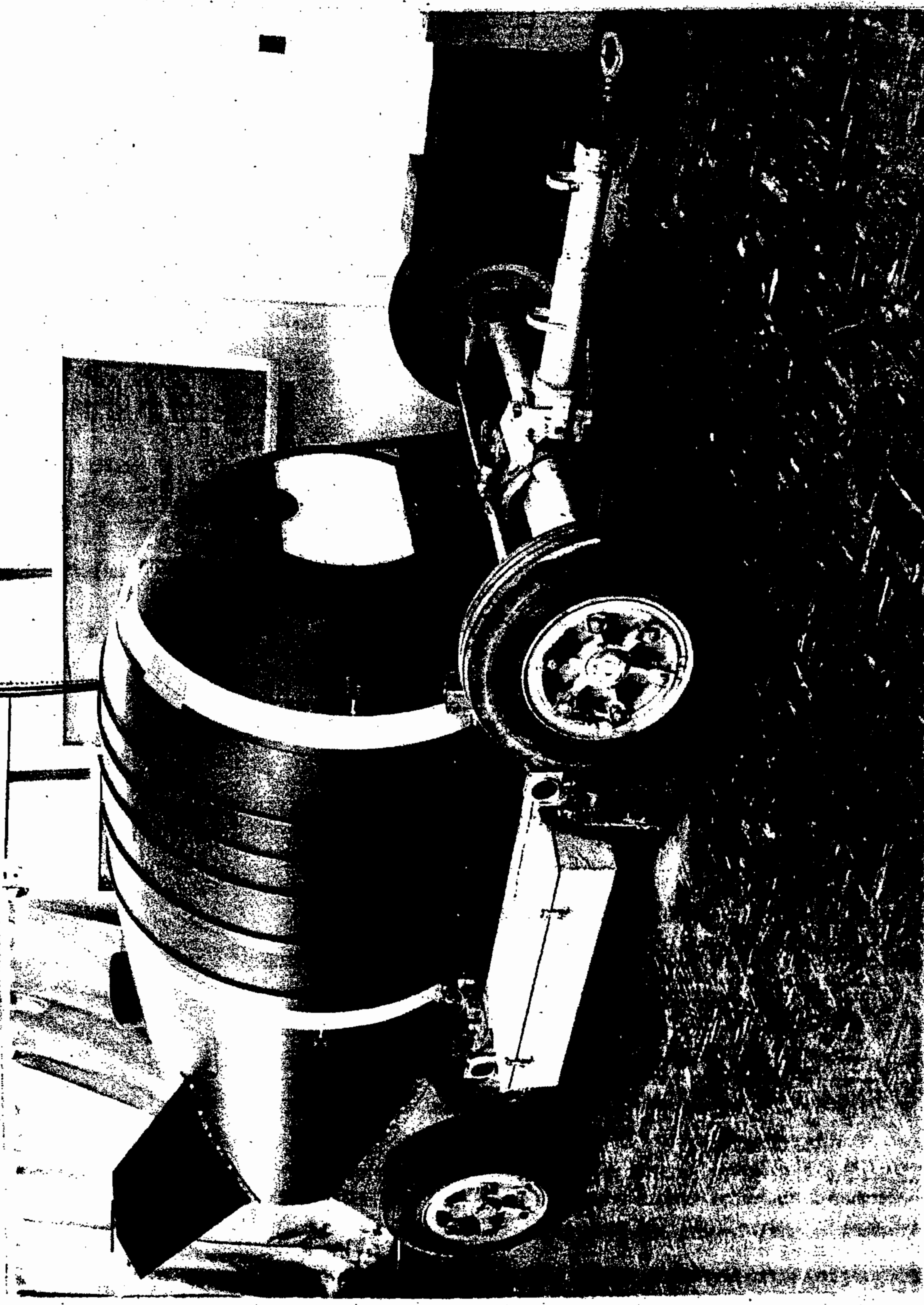

Mk 6 Bomb on Trailer

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radars. (b)(3)

Height-of-burst settings would be adjustable in six steps before weapon assembly, and any one of the six settings could be selected by remote control from the strike aircraft before release. The ranges of these six steps would overlap each other.[16]

Some attention had previously been paid to the possibility of providing inflight insertion. Currently, it was necessary to manually extract two heavy blocks of high explosive, insert the nuclear capsule, replace the high explosive, and button up the assembly. This was tedious and time-consuming, and required that the strike aircraft fly at fairly low altitudes (and thereby at a high rate of fuel consumption) during the insertion process, as the aircraft bomb bays were not pressurized.

The Los Alamos Scientific Laboratory had notified the Division of Military Application that a suitable inflight insertion system could be developed by early 1949.[17] The Division had replied, July 14, 1948, that the Military would gain in safety and logistics if both insertion and extraction in flight could be provided. It was requested that these changes be incorporated as soon as possible.[18]

Los Alamos stated that nuclear efficiency could be improved by better timing of nuclear initiation and that this could be accomplished by use of an external neutron source. (b)(3)

Although this was highly desirable, the Board felt that it would be criticized if production of the Mk 6 was delayed, and suggested that this design revision be held in abeyance.[20]

The design also used nickel-cadmium batteries or Mk 2 Power Supply. These batteries replaced a lead-acid design and provided greatly improved operational readiness, since they could be charged in less time and be stored in the charged condition for longer periods. The Mk 6 Mod 5 Bomb entered stockpile in May 1953.

Mk 6 Mod 6 Bomb

The broad objectives of the Mod 6 were to provide contact fuzing and a Mach-insensitive barometric sensing system. This latter system was one which the Military had been requesting for some time.[60] It would provide the correct atmospheric pressure to the baroswitches regardless of the rate of fall of the weapon. Corrections to baroswitch settings were required to compensate for the varying effect of air flow past baroswitch ports at different Mach numbers. Making this correction was troublesome as it involved use of complicated tables incorporating the latest meteorological data, estimating the speed of weapon fall at the altitude at which the baroswitches were to close, and accurately controlling the speed and altitude of the strike aircraft at the time of drop. These problems were discussed at the August 8, 1951 meeting of the Sandia Weapons Development Board, and a formal recommendation was made that development emphasis be continued on a Mach-insensitive design.[32]

The emphasis was applied, but solutions to the problem were found to be quite elusive.[61] Early experiments with drag cones and trailing probes showed some promise. These devices placed the pressure pickup far enough behind the falling bomb to be relatively free of the effect of air flowing past it.

The drag cone showed especially good statistical reliability when the pressure orifices were located at the end of an 18-foot length of flexible hose attached to the bomb tail plate. This proved to be a difficult mechanical installation, however, as the buffeting effect of the air exerted forces on the hose which exceeded the breaking strength of the material, even when stainless-steel hose was tested. Deployment of the device as the bomb fell away from the carrying

Sandia presented Report SC3271(TR), Design Description and Status Report of the Station 124 Pressure Sensing System for the TX-6-X4 Weapon, to the March 31, 1954 meeting of the Special Weapons Development Board. This report described the pressure-sensing system, discussed its capabilities, and summarized the test results. It appeared possible to use a single pressure offset when determining the baroswitch setting, and accept some degradation for those few burst heights (about 2 percent) which would be made at speeds higher than Mach 0.9.[68]

Sandia presented Report SC2540(TR), Engineering Evaluation of the Mk 6 Mod 6 Bomb with Mk 13 Mod 0 Fuze, to the January 12, 1955 meeting of the Special Weapons Development Board. Basic changes included the Mach-insensitive pressure-sensing system and a contact fuze. Contact-fuze tests had included 75-millimeter gun firings to simulate a spike impact, and sled tests to measure sensitivity of the system to rain impact. The Mk 6 Mod 6 entered stockpile in January 1955, and all previous modifications were converted to this design.

Stability of the bomb was satisfactory, except for drops made from B-47 aircraft at low altitudes and high speeds. In these cases the weapon pitched considerably upon release, due to the aerodynamics of the airplane and the bomb. This particular delivery required that bombing-table corrections be made to achieve the desired ballistic accuracy. All components and systems operated satisfactorily during fuzing and firing drop tests.[69]

The bomb diameter was 61 inches, its length 128 inches, and its weight 8170 pounds. (b)(1), (b)(3)

Prior to takeoff, aircraft power was supplied to timer and battery heaters and trigger-circuit filaments. (b)(1), (b)(3)

The safing switch was placed to the arm position.

At bomb release, the pullout switches closed, starting the safe-separation timer and the inverters, and switching the trigger-circuit filaments from aircraft power to internal battery power. At the end of the preset safe-separation time, battery power was provided to the arming relay, which could not operate until the arming baroswitch closed and furnished a path to ground. (b)(1), (b)(3)

Operation of the arm relay then connected the inverter output to the firing-set charging circuits. The firing set completed its charge in about 0.5 second. Three seconds after safe-separation time, another switch in the safe-separation timer closed, completing the fuzing-baroswitch ground circuit, and the weapon was now ready for air-burst detonation.

If the fuzing baroswitch had been set for air burst, it closed at the predetermined altitude, forming a negative pulse which was applied to the trigger-circuit cathodes, firing both thyratrons. The output pulse of the trigger circuit fired both gaps, discharging the main bank condenser energy into the detonator bridge wires, with resultant weapon detonation. If the air-burst fuze failed, detonation occurred at impact.

If the fuzing baroswitch had been set for contact detonation, or if the air-burst fuze failed, impact of the weapon with the target resulted in detonation. The impact caused the crystals to generate a voltage which was applied to both thyratron grids, and the resultant firing of either thyratron initiated the firing sequence.[70]

(b)(3)

The Board met December 11, 1951 and accepted the proposed design.[50] Since the weapon was now no longer interchangeable with other Mk 6 Bombs--a different capsule being required--it was designated the Mk 18.

Only pit and capsule were affected, so most of the development work was carried out by Los Alamos. (b)(3) implosion system. However, upon cancellation of the TX-13 in August 1954, the TX-20 program was similarly deleted.

Retirement

With the development of thermonuclear weapons, as well as fission devices of more advanced design, the Mk 6 became obsolete. Removal from stockpile started in 1957 and by July 1962 all Mk 6 units had been retired.

[redacted]

Glossary of Mk 4 Terms

<u>Ad Hoc Working Group</u> -- A group established by the Guided Missiles Committee to oversee the design of one particular missile-warhead installation.

<u>Air Force Special Weapons Center</u> -- That element of the Air Force Systems Command having to do with compatibility testing of nuclear devices with aircraft. Located at Kirtland Air Force Base, Albuquerque, New Mexico.

<u>Armed Forces Special Weapons Project</u> -- An interdepartmental agency formed to handle military functions related to atomic weapons.

<u>Arming</u> -- The act of arming a weapon, that is, preparing it for firing.

<u>Ballistics</u> -- The science governing motion of projectiles or bombs dropped from aircraft.

<u>Barium Titanate Fuze</u> -- An assembly which, when squeezed or struck, produces a pulse of electricity.

<u>Barometric Fuze</u> -- Fuze incorporating a baroswitch. A pressure device actuated by increasing air pressure as the weapon descends in its trajectory.

<u>Baroswitch</u> -- A switch actuated by air pressure.

(b)(3)

<u>Department of Defense</u> -- The Armed Forces, i.e., the Army, Navy and Air Force.

Kilogram -- A metric weight approximating 2.2 pounds.

Kiloton -- A means of measuring the yield of an atomic device by comparing its output with the effect of an explosion of TNT. A 1-kiloton yield is equivalent to the detonation effect of 1000 tons of high explosive.

(b)(3)

Mach -- A measure of speed. Mach 1.0 is the speed of sound, or 738 miles per hour at sea level.

Megaton -- A measure of yield of a large weapon. One megaton is the equivalent of 1,000,000 tons of high explosive.

Military Characteristics -- The attributes of a weapon that are desired by the Military.

Military Liaison Committee -- A department of Defense committee established by the Atomic Energy Act to advise and consult with the AEC on all matters relating to military applications of atomic energy.

NAVAHO -- A supersonic long-range missile developed for the Air Force by North American Aviation, Inc.

Neutron -- An uncharged particle of slightly greater mass than the proton.

Nose Probe -- A hollow tube extending in front of a bomb to register air pressure in relatively undisturbed air.

Nuclear Insertion -- Insertion of the nuclear capsule when the weapon is ready to be armed for detonation. An atomic weapon with a retracted capsule is relatively safe, and will only produce a yield equivalent to the amount of high explosive in the weapon.

(b)(3)